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AUTOMATIC SYSTEM FOR TAKING UP AND HANDLING A CONNECTING TOWROPE  
BETWEEN A TUGBOAT AND A TOWED VESSEL

SPECIFICATION

OBJECT OF THE INVENTION

5           The present patent of invention application has as an object the registration of an automatic system for taking up and handling a connecting towrope between a tugboat and a towed vessel incorporating notable innovations and advantages compared to the current methods for the same or similar purpose.

10           More specifically, the new invention comprises an installation for its assembly on the deck of a tugboat, which allows handling the connecting towrope between the tugboat and towed vessel without the necessity of a worker having to be on said deck to perform manual operations. The new invention  
15 consists of a fastening carriage which moves on guides around the deck of the tugboat. Once the towrope has been launched from the vessel to be towed, the carriage moves until a built-in sensor detects the presence of the towrope at the level of the gunwale. The fastening carriage fixes the tow cable or rope of  
20 the tugboat in the clamp, and once it is detected that the towrope is introduced in the clamp, said clamp is closed and released from the carriage, the cable of the tugboat remaining connected to the towrope of the vessel. Once the operation has been performed, the fastening carriage returns to its rest  
25 position.

BACKGROUND OF THE INVENTION

The operation of connecting the tow cable of the port tugboat to the vessel which is ready to enter or exit the port is usually carried out as follows:

30           a) The tugboat approaches the vessel from the bow or stern, depending on where the Pilot or Capitan of the vessel which must be connected has instructed.

          b) When the tugboat is close to the vessel, a sailor from the vessel launches a towrope made of braided cable, usually  
35 incorporating a ball on the end which is launched so that the weight of the ball drags the thin cable of the towrope, being

able to go as far as possible as if a rock had been launched. The ball strikes against the deck of the tugboat, the other end of the towrope remaining on board the vessel, a sailor of which had launched it.

5           c) A crew member of the tugboat takes up the towrope which has been launched from the vessel and has landed on the deck. The crew member immediately ties it to the tow cable of the tugboat.

10           d1) The vessel begins to take up or heave in the towrope at the same time that, from the tugboat, all the tow cable coiled onto the towing winch is left with slack or loose, or in any case, is let out, actuating its uncoiling from the drum of the towing winch while it is being heaved in from the boat. When the towrope has been taken up from the vessel, tied thereto is  
15           usually a somewhat thicker textile rope which, duly arranged on a capstan or windlass on board, allows taking up the rest of the towline usually formed by a steel cable or by a thick braided textile rope or by a combination of both. When the steel cable forming a loop appears on board the vessel, the loop is rigged  
20           on a bitt or haul point, while at the same time from the tugboat the cable is not left loose and the towing winch is stopped, the vessel and tugboat being fixedly connected after this moment. The connecting maneuver has concluded.

25           d2) The operation described above corresponds to the manner of working in ports in which the tow cable is furnished by the tugboat, the latter being responsible for its storage and good condition. When the tow cable is provided by the boat, the first three operations are the same, and only the last one changes. In this case, it is the sailor of the tugboat who takes up the  
30           towrope launched from boat and begins to heave in the tow cable until the loop of the hawser or cable, which is rigged onto the towing hook of the tugboat, reaches him. This way of working is falling into disuse, in detriment of that described above, because the tugboat is responsible for the condition of the  
35           cable, and in the case of accidents in vessel maneuvers caused by the breaking of a cable in poor conditions, liability of the tugboat company can be sought.

d) After this moment, the tugboat follows the instructions it receives from the vessel in the sense of hauling in one direction or the other in order to aid the vessel in its port entry or exit maneuver.

5 Over the years, the way of working has not changed mainly due to the difficulty entailed in the introduction of changes in a way of working that is consolidated over time and in all ports worldwide. The marine elements, bitt, spurling pipe, towrope, capstan, windlass, winch, bollard, loop, cable, etc. are known  
10 and used worldwide in all boats and ports of the world. Any change implying the implementation of new devices in vessels and docks will be very difficult to consolidate if it is not imposed worldwide, and only the changes allowing the performance of the same tasks in an easier and simpler manner have possibilities to  
15 be successful.

Document publication number 1,023,290 corresponding to a utility model of equipment for vessel rigging and mooring is related to the operation mentioned in d2). However, the applicant has observed that this way of working is falling into  
20 disuse. The implementation of the facility disclosed in the publication is unknown by the same, given that of all the tugboats which the inventors have visited, they did not see it implemented.

Document publication number 2,064,206 corresponding to a  
25 patent of invention applicable in tugboats is more aimed at the functions of docking and undocking than the operations described above. It partially discloses the application of the invention for a vessel towing operation in which a telescopic arm performs the connection operation by itself to the towed vessel without  
30 needing to perform the previously described operations. The implementation of the invention of this publication is unknown by the inventors and the applicant since its existence has not been verified in any tugboat.

#### DESCRIPTION OF THE INVENTION

35 The automatic system for taking up and handling a connecting towrope between a tugboat and a towed vessel of the present registration is characterized in that it comprises great

advantages without meaning any change whatsoever to the overall connecting process disclosed above corresponding to the current state of the art. The process will continue to be the same and the changes made by the new invention mainly affect the fact that the presence of a crew member on the deck of the tugboat for taking up the towrope and fastening it to the tow cable is not required since this operation is carried out by a fastening carriage.

Said fastening carriage carries out the following operations:

1. Detecting the presence of the towrope at the level of the gunwale where it is supported after having been launched from the vessel to be towed.
2. Fixing the towrope with the clamp.
3. Releasing the clamp from the carriage.
4. Returning to its rest position until a new operation, the start of which must be actuated from the tugboat bridge.

The new invention is made up of a guide rail arranged around the tugboat on which the fastening carriage automatically moves. The fastening carriage has a presence detector which, upon reaching the point where the towrope is located, urges the carriage to stop. A clamp or latch-type gripping system, which carries the tugboat cable secured, grips the towrope, fixes it, and the carriage is released. Once this operation has been performed, the fastening carriage returns to a given position or resting point where it is not in the way. The fastening carriage carries out this process automatically, although the beginning of the process is commanded from the control bridge of the tugboat by pushing the corresponding control on the system control console after the moment in which the ball strikes against the deck and the towrope is supported on the gunwale. System operation can be switched from automatic to manual form also from the control console.

In manual operation, movement the fastening carriage is controlled from the control console. This is because the ball of the towrope can be trapped at some point of the deck, preventing

the correct automatic operation of the process. In this manner, should this circumstance occur, the fastening carriage can be commanded from the control bridge of the tugboat to perform the necessary operations individually so that the ball and the towrope can be released from the obstacles preventing them from automatically operating. Should it be impossible to release the towrope by means of the manual operation on the control console installed in the control bridge, attempting the movements of the fastening carriage individually, the use of a small self-driven vehicle on the deck is further contemplated, with the direction of movement, speed and angle of rotation controlled by radio from the same bridge, as if it were a toy.

The main advantage of the invention with regard to the prior state of the art is that the presence of a crew member on the deck of the tugboat during the connecting operation is not necessary, entailing greater security for the crew. It is necessary to consider that this connecting task is done many times in poor sea and little visibility conditions, with rain, etc., conditions which can cause an accident due to the slipping, tripping or falling of the crew member. The skipper who is in the bridge must pay attention to the vessel to which it is going to connect and at the same time to the crew. With the invention, the skipper must only be concerned with the vessel since there is no crew member on deck. After the moment in which the towrope strikes against the deck, the start button must simply be pushed. The remaining operations are the same as those currently done and are now carried out from the bridge.

To complete the description that will be given below and for the purpose of aiding to better understand its features, a set of illustrative and non-limiting figures are attached to the present specification, in which the most significant details of the invention are represented.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a perspective view of a tugboat with the newly invented device.

Figure 2 shows a perspective view of the fastening carriage on the guide rail.

Figure 3 shows a profile view of the carriage on the guide and with the towrope supported on the gunwale.

Figure 4 shows a front perspective view of the inside of the fastening carriage on the guide rail.

5        Figure 5 shows a rear perspective view of the inside of the fastening carriage on the guide rail.

Figure 6 shows a block diagram of the electronic configuration of the invention.

#### DESCRIPTION OF A PREFERRED EMBODIMENT

10        In view of the discussed figures and according to the numbering adopted, observed therein is a preferred although non-limiting embodiment of the invention which consists of guide rails (6) made up of two cylindrical calibrated rails preferably of polished and tempered stainless steel, which go around all or  
15        part of the tugboat (1). These rails (6) are joined by means of screws, welds or the like to the supports (5), which are assembled on the deck (2) of the boat. There is a longitudinally movable fastening carriage (7) on this guide (6).

20        The fastening carriage (7) comprises a structure or frame (8) incorporating a duly protected electric motor (9) which, by means of rotation reduction pulleys (27) and the corresponding belts (28), is connected to two drive wheels (24) of grooved profile, supported on one of the rails (6) of the guide. In a position opposite to the two drive wheels (24), the frame (8)  
25        has two other idle wheels (25) on a support (26) which presses them against the other rail (6) of the guide. In turn, the frame (8) has supports (10) of a rechargeable battery (18) for supplying electrical power to the motor (9) and to control the circuitry (19 and 22). The frame (8) has a projecting arm (29)  
30        opposite to the guide (6) with an adjustable mechanism (11) incorporating a clamp mechanism (12) with a sensor (21) for detecting the presence of the towrope (4) and two V-shaped open guiding rods (23) of said towrope (4) supported on the gunwale (3) towards the clamp (12). The rod-clamp (12 and 23) assembly  
35        mechanism is arranged at the level of the gunwale (3). The clamp (12) is joined with the cable line (not represented) and is

releasable when a lock solenoid (20) thereof joining said cable with the towrope (4) of the towed vessel is actuated.

5 The control circuitry (19) of the carriage (7) is made up of a radio transmitter equipment, a speed and motor running/stop control, a controller of the sensor (21) of the clamp (12), and  
10 an actuator of the lock solenoid (20) of the clamp. The radio transmitter equipment (22) of the carriage (7) is connected to an equivalent radio transmitter equipment (15) in the control console (13) of the bridge for the automatic or manual handling of said carriage (7) with the corresponding controls (14) of speed adjustment, start/stop, movement direction of the carriage (7) and locking of the solenoid (20) of the clamp (12).

15 The fastening carriage (7) incorporates a recharging mechanism (17) of the battery (18) made up by means of sockets that can be coupled to a base (16) existing at a point that is away from the path of the guide rails (6), or alternatively by means of a non-contact induction charging system. The base (16) of the recharging system can be in its rest position, arranged on the bow or in the area where it is less bothersome. Said  
20 recharging system (16) can be secured by means of a latch or catch system which is released in the moment of starting its running from the control console (13).